PTLK Inverter

Tek Drive

TDS-V8

MODBUS Communication Application Manual

Please ensure the user gets this manual, for the optimal use of this device.

TEK-DRIVE / TDS-V8 INVERTER

MODBUS Communication

1. Introduction:

PTLK / TDS-V8 INVERTER uses the RS-485 series communication port and Modbus protocol for connecting with a PLC. Up to 31 inverters can be monitored and controlled simultaneously by a host controller with such links.

2. TDS-V8 Communication specifications:

(1) Uses RS-485 series communication port for Hardware link.

(2) Communication Format: Modbus RTU mode protocol.

(3) Communication Format setting: via setting of parameters Sn-36, Sn-37 and Sn-38:

(i) Parameter Sn-36 = 1~31 …Communication address (default =1)

In the Communication Format, each communication unit requires a unique address, up to 31 inverters can be linked.

(ii) Parameter Sn-37 = 0~3 ------ transfer speed (default =3)

Parameter Sn-37 = 0 ------ 1200 Bps

Parameter Sn-37 = 1 ------ 2400 Bps

Parameter Sn-37 = 2 ------ 4800 Bps

Parameter Sn-37 = 3 ------ 9600 Bps

For setting RS-485 communication transfer speed

(iii) Parameter Sn-38 = 0~2 ------ Parity setting (default =0)

Parameter Sn-38 =0 ------ No Parity

Parameter Sn-38 =1 ------ Even Parity

Parameter Sn-38 =2 ------ Odd Parity

Parity format in RS-485 communication set by Sn-38.

(Note): In case of changing Sn-37 or Sn-38, the inverter must be switched OFF and re-started again.

(4) Other parameters related to RS-485:

(i) Setup inverter response mode during a RS-485 communication failure:

Parameter Sn-39 = 0~3 ------ Inverter stop method during RS-485 communication failure (default =0)

Parameter Sn-39 = 0 ------ decelerate according to bn-02

Parameter Sn-39= 1 ------ stop by free run

Parameter Sn-39= 2 ------ decelerate according to bn-04

Parameter Sn-39= 3 ------ continue to run (can be stopped by pressing “STOP”)

(ii) Setup Detection time for releasing alarm after a communication failure:

Parameter Cn-27 = 00.0~25.5s ------ Detection time for communication failure (default =01.0s)

Parameter Cn-27 = 00.0 s ------ for “No Detection” of communication failure

When the Cn-27 set period elapses, the digital controller will display “ CErr ”

(iii) For setting up whether RS-485 is used for command source:

Parameter Sn-04= 2 ------ Operation Command comes from RS-485 port.

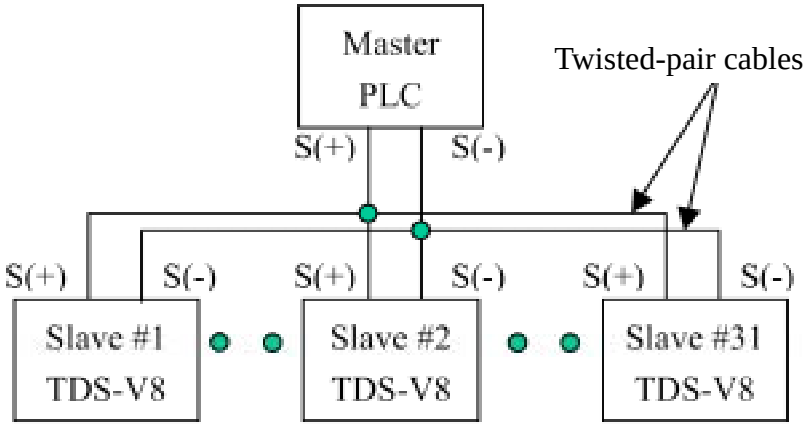
Parameter Sn-05= 2 ------ Frequency Command comes from RS-485 port.

(iv) For setting up that the signal of the inverter output terminal comes from RS-485 port.

Parameters Sn-30, Sn-31 and Sn-32 = 25 ------ signal of the Digital output terminal comes from RS-485 port.

3. TDS-V8 connections:

RS-485 series communication port comprises S(+) and S(-) pins for semi-duplex communication transfer. For connecting multi RS-485 ports, just series-link all the S(+)s and all the S(-)s respectively.



RS-485 connecting diagram

4. TDS-V8 connection procedures:

(1) Power ON the inverter, then setup RS-485 related parameters and connect the RS-485 cable. Communication with the controller is now enabled.

(2) During wiring the cable, if the inverter parameter setting for Operation/Frequency command comes from RS-485 port (Sn-04=2 or Sn-05=2), if the inverter, in the STOP mode, does not receive any information in the period set by Cn-27, the digital controller will display the “ CErr ” blinking message, indicating that the system is in standby for communication. On receipt of data, the blinking message will go off. During the operation, if no data comes in during the period set by Cn-27, the system will respond according to the Sn-39 setting, and the digital controller will display the “ CErr ” error message.

5. The Modbus RTU protocol:

(1) Definition of the Character:

In the Modbus RTU mode, each Character, or byte, is composed of 11 bits: 1 start bit, 8 data bits, 1 parity bit and 1 stop bit. If Sn-38=0 for “No Parity”, the parity bit shall be set “1”. The transfer carries out one by one starting from the start bit. The following are the formats of the character:

Character with parity check:

LSB										MSB
1	2	3	4	5	6	7	8	9	10	11
Start bit	Data bit 0	Data bit 1	Data bit 2	Data bit 3	Data bit 4	Data bit 5	Data bit 6	Data bit 7	Parity bit	Stop bit

Character without parity check:

LSB									MSB
1	2	3	4	5	6	7	8	9	10	11
Start bit	Data bit 0	Data bit 1	Data bit 2	Data bit 3	Data bit 4	Data bit 5	Data bit 6	Data bit 7	Stop bit	Stop bit

(2) Definition of a Message:

In the Modbus RTU mode protocol, each message comprises 4 components namely Slave Address, Function Code, Data and Checking Code (CRC-16). Messages are separated with starting and ending periods equal to the length of 3.5 Characters. The message format is as follows:

Period > length of 3.5 Characters	Communication Address (Slave Address)	Function Code	Data	Checking Code (CRC-16)		Period > length of 3.5 Characters
	1 Character	1 Character	n Character	CRC_L	CRC_h	

(3) Message format:

(i) Communication Address (Slave Address)

One Character-length is used for the RTU mode communication address of the inverter in the message. Parameter Sn-36 is used for setting up this address, with the range of 1~31.

Message sent by the Master can be received by all Slaves, but only the one with the same Slave Address as that in the message will execute the received message, with a response sent back to the Master. When the Master sends a message with the Slave Address set as “0”, all slaves will execute the massage without sending back any response.

(ii) Function Code

One Character length is used for the RTU mode function Code in a message, for making the slave execute the command. Function Codes used by this inverter are listed as follow; each function will be detailed in “Message Mode”.

Function Code	Function
03H	Read data from Register
06H	Write a single datum to Register
08H	Loop test
10H	Write data to Register

(iii) Data

Due to different data requirements of different functions, the data bytes of different messages have different lengths; detailed discussions will be given in “Message Mode”.

(iv) Checking Code (CRC-16)

In the message format, a CRC-16 checking code of 2 characters long is used for errors in the transferred data. CRC-16 is a 16-bit binary value. When transferred, checking code of the low-byte is transferred first, then that of the high-byte. CRC-16 is operated as follows:

① Set CRC_16 as FFFFH.

② Execute XOR operation for the low-byte of the CRC_16 with the first byte of the message, send the result back to the low-byte of the CRC_16.

③ LSB of CRC_16 is 0, CRC_16 is shifted one bit to the right, with a 0 filled into the highest bit. If LSB of CRC_16 is 1, CRC_16 is shifted one bit to the right, with a 0 filled into the highest bit, and than execute XOR with A001H.

④ Repeat step ③ until shifting to the right 8 times.

⑤ Repeat steps ②~④ for the next byte of the message, until all bytes are done.

The final CRC_16 value is the check code of the CRC_16.

Use Basic to run CRC_16, for example:

```
Function CRC_16(message$) as long
crc16& = 65535
FOR CHAR% = 1 to LEN (message$)
    crc16& = crc16& XOR ASC (MID$ (message$, CHAR%, 1))
    FOR BIT% = 1 to 8
        IF crc16& MOD 2 THEN
           crc16& = (crc16& \ 2) XOR 40961
        ELSE
           crc16& = crc16& \ 2
        END IF
    NEXT BIT%
NEXT CHAR%
crc_hi% = crc16& \ 256
crc_lo% = crc16& MOD 256
message$ = message$ + CHR$(crc_lo%) + CHR$(crc_hi%)
CRC_16 = crc16&
END FUNCTION CRC_16
```

(4) Message mode:

Messages are divided into commands and responses. Messages send from Master to a Slave is a Command, the respond send back to Master by a Slave is a Response. In general conditions, after 5ms a Command will be responded by the Slave with the denoted address. No response will be given by any Slave for the following conditions:

① The “Slave Address” in the Commend does not match with any of the linked Slaves.

② An error is detected when the Slave receives the message (Parity, Framing, Overrun, or CRC-16 error).

6. TDS-V8 message format

TDS-V8 Inverter accepts only 3 types of command messages: Read data from (03H), Loop Test (08H) and Write data to (06H and 10H). See the following table:

Command	Function Code	Function	Host Query		Inverter return	
			Byte (Min.)	Byte (Max.)	Byte (Min.)	Byte (Max.)
Data Read	03H	Read data from Holding Register	8	8	7	37
Data Write	06H	Write a single datum to Register	8	8	8	8
Loop Test	08H	Loop test	8	8	8	8
Data Write	10H	Write data to Register	11	41	8	8

Command and Inverter return formats acceptable to the Inverter:

(1) Read command (03H):

Read data from Register. Data of a maximum of 16 registers can be read at a time.

Command message

Slave Address		01H
Function Code		03H
Head Address	High Byte	00H
	Low Byte	20H
Access Count	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	85H
	Low Byte	C0H

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		83H
Error code		03H
CRC-16	High Byte	01H
	Low Byte	31H

Inverter Return (Normal)

Slave Address		01H
Function Code		03H
Data Byte Count		02H
Head Address	High Byte	08H
	Low Byte	02H
CRC-16	High Byte	3EH
	Low Byte	45H

(2) Write command (06H):

Writes datum to a holding register. If the Slave Address in the Write Command is set to 0, all Slaves on-line will receive and execute this message, but this can only be used for setting register addresses 0000H and 0001H. No response will be made by any Slave. If Write Command is used for changing parameters, the change is not saved into EEPROM when the machine is switched off. For saving into EEPROM, it must be written into address 0500H.

Host Query

Slave Address		01H
Function Code		06H
Head Address	High Byte	00H
	Low Byte	01H
Data character byte	High Byte	00H
	Low Byte	20H
CRC-16	High Byte	D9H
	Low Byte	D2H

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		86H
Error Code		03H
CRC-16	High Byte	02H
	Low Byte	61H

Inverter Return (Normal)

Slave Address		01H
Function Code		06H
Head Address	High Byte	00H
	Low Byte	01H
Data character byte	High Byte	00H
	Low Byte	20H
CRC-16	High Byte	D9H
	Low Byte	D2H

(3) Loop Test Command (08H):

Check if communication circuit is normal

Slave Address		01H
Function Code		08H
Test Code	High Byte	00H
	Low Byte	00H
Test Data	High Byte	12H
	Low Byte	34H
CRC-16	High Byte	EDH
	Low Byte	7CH

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		88H
Error Code		03H
CRC-16	High Byte	06H
	Low Byte	01H

Inverter Return (Normal)

Slave Address		01H
Function Code		08H
Test Code	High Byte	00H
	Low Byte	00H
Test Data	High Byte	12H
	Low Byte	34H
CRC-16	High Byte	EDH
	Low Byte	7CH

(4) Write Command (10H):

Writes multiple data to holding register. A maximum of 16 registers can be written at a time. If the Slave Address of the Write Commend is set to 0, all Slaves on-line will receive and execute this message, but this can only be used for setting register addresses 0000H and 0001H. No response will be made by any Slave. If Write Command is used for changing parameters, the change is not saved into EEPROM when the machine is switched off. For saving into EEPROM, it must be written into address 0500H.

Host Query

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	01H
Data byte Count*		02H
The first data character byte	High Byte	00H
	Low Byte	30H
CRC-16	High Byte	A7H
	Low Byte	95H

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		90H
Error Code		03H
CRC-16	High Byte	0CH
	Low Byte	01H

Inverter Return (Normal)

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	50H
	Low Byte	09H

* Number of data bytes is 2 times of Access Count.

7. TDS-V8 Registers:

There are 3 types of registers: Control, Monitor and Inverter Parameters:

Register Type	Register Property	Register Address
Control Data	Read/Write	0000H~000FH
Monitor Data	Read-only. Non-Writeable	0020H~002FH
Inverter Parameter Data	Read/Write	0100H~0500H

(1) Control Data register (Read/Write): Register for controlling inverter operation

List of Control Data Registers

Address	Bits	Function Description
0000H (*1)	0	0: STOP; 1: RUN
	1	0: Forward; 1: Reverse
	2	External Fault (0: disable; 1: enable)
	3	Fault Reset (0: disable; 1: enable)
	4~7	Reserved
	8	0: disable; 1: switch from PRG mode to DRV mode, auto clear to 0
	9	0: disable; 1: switch from DRV mode to PRG mode, auto clear to 0
	10~15	Reserved
0001H(*1)	Frequency Command: 7530H /100% (30000/100%); 100% =Cn-02	
0002H~0006H	Reserved	
0007H	0	Output terminal R1A-R1B-R1C output setting; 0: disable; 1: enable
	1	Output terminal DO1-DOG output setting; 0: disable; 1: enable
	2	Output terminal R2A-R2C output setting; 0: disable; 1: enable
	3~15	Reserved
0008H~000FH	Reserved	

*1. This control data register can be used for Slave Address “0” write-in message.

(2) Monitor Data Register (Read-only. Non-Writeable): For monitoring Inverter operation status

List of Monitor Data Registers

Address	Bits	Function Description
0020H	0	0: STOP; 1: RUNNING
	1	1: Zero Speed
	2	0: Forward; 1: Reverse
	3	1: Inverter Ready

	4	0: PRG mode; 1: DRV mode
	5	0: 220V series; 1: 440V series
	6	1: Inverter Alarm
	7	1: Inverter Fault
	8	Reserved
	9	
	10	
	11	1: LCD Digital Operator
	12	0001: Parameter Setting Invalid 0010: Multi-Function Digital Input Parameter Setting Invalid 0011: Auto-Run Mode Parameter Setting Invalid 0100: V/F Pattern Parameter Setting Invalid 0101: Frequency Limited Parameter Setting Invalid 0110: Jump Frequency Parameter Setting Invalid 0111~1111: Reserved
	13	
	14	
	15	
0021H	0	1: Under Voltage Fault (UV1)
	1	1: Over Current Fault (OC)
	2	1: Over Voltage Fault (OV)
	3	1: Over heat Fault (OH)
	4	1: Motor Over Load Fault (OL1)
	5	1: Inverter Over Load Fault (OL2)
	6	1: Output Over Torque Fault (OL3)
	7	1: External Fault 3 (EF3)
	8	1: External Fault 5 (EF5)
	9	1: External Fault 6 (EF6)
	10	1: External Fault 7 (EF7)
	11	1: External Fault 8 (EF8)
	12	1: EEPROM Fault
	13	1: CPU A/D Fault
	14	1: Ground Fault (GF)
	15	Reserved
0022H	0	Reserved
	1	
	2	1: Braking Resistor Over Heat Alarm
	3	1: RS-485 Communication transfer Alarm
	4~15	Reserved
0023H	0	1: Under Voltage Alarm (UV)
	1	1: Over Voltage Alarm (OV)
	2	1: Over Heat Alarm (OH)

	3	1: Over Torque Alarm (OL3)
	4	1: Two Line Terminal 1,2 External Alarm (EF)
	5	1: Base Block Alarm (bb)
	6	1: EEPROM Alarm
	7	1: External Alarm 3
	8	Reserved
	9	
	10	
	11	1: Braking Resistor Over Heat Alarm
	12	1: RS-485 Communication Alarm
	13	Reserved
	14	
	15	
0024H	Frequency Command (30000/100%) 100%=Cn-02	
0025H	Output Frequency (30000/100%) 100%=Cn-02	
0026H	Output Voltage 1V/1	
0027H	Output Current 0.1A/1	
0028H	Main circuit DC Current 1V/1	
0029H	Analog Input VIN Value; 10V/100.0%	
002AH	Analog Input AIN Value; 20mA/100.0%	
002BH	Analog Input AUX Value; 10V/100.0%	
002CH Input Terminal status	0	Terminal 1 0: Open; 1: Close
	1	Terminal 2 0: Open; 1: Close
	2	Terminal 3 0: Open; 1: Close
	3	Terminal 4 0: Open; 1: Close
	4	Terminal 5 0: Open; 1: Close
	5	Terminal 6 0: Open; 1: Close
	6	Terminal 7 0: Open; 1: Close
	7	Terminal 8 0: Open; 1: Close
	8~15	Reserved
002DH	Analog Output AO1 Value; 10V/100.0%	
002EH	Analog Output AO2 Value; 10V/100.0%	
002FH Output Terminal status	0	Terminals R1A-R1B-R1C 0: Open; 1: Close
	1	Terminals DO1-DOG 0: Open; 1: Close
	2	Terminals R2A-R2C 0: Open; 1: Close
	3~15	Reserved

(3) Inverter Parameter Register (Read/Write): List of Inverter Parameter vs. Register Address

List of Inverter Parameter Register

Address	Inverter Parameter		Unit	Setting Range
0100H	An-01	Frequency Command 1	0.01Hz	0.00~400.00 Hz
0101H	An-02	Frequency Command 2	0.01Hz	0.00~400.00 Hz
0102H	An-03	Frequency Command 3	0.01Hz	0.00~400.00 Hz
0103H	An-04	Frequency Command 4	0.01Hz	0.00~400.00 Hz
0104H	An-05	Frequency Command 5	0.01Hz	0.00~400.00 Hz
0105H	An-06	Frequency Command 6	0.01Hz	0.00~400.00 Hz
0106H	An-07	Frequency Command 7	0.01Hz	0.00~400.00 Hz
0107H	An-08	Frequency Command 8	0.01Hz	0.00~400.00 Hz
0108H	An-09	Frequency Command 9	0.01Hz	0.00~400.00 Hz
0109H	An-10	Frequency Command 10	0.01Hz	0.00~400.00 Hz
010AH	An-11	Frequency Command 11	0.01Hz	0.00~400.00 Hz
010BH	An-12	Frequency Command 12	0.01Hz	0.00~400.00 Hz
010CH	An-13	Frequency Command 13	0.01Hz	0.00~400.00 Hz
010DH	An-14	Frequency Command 14	0.01Hz	0.00~400.00 Hz
010EH	An-15	Frequency Command 15	0.01Hz	0.00~400.00 Hz
010FH	An-16	Frequency Command 16	0.01Hz	0.00~400.00 Hz
0110H	An-17	Jog Frequency Command	0.01Hz	0.00~400.00 Hz

Address	Inverter Parameter		Unit	Setting Range
0200H	Bn-01	Acceleration time 1	0.1s	0.0~6000.0s
0201H	Bn-02	Deceleration time 1	0.1s	0.0~6000.0s
0202H	Bn-03	Acceleration time 2	0.1s	0.0~6000.0s
0203H	Bn-04	Deceleration time 2	0.1s	0.0~6000.0s
0204H	Bn-05	Analog frequency command VIN gain	0.1%	0.0~1000.0%
0205H	Bn-06	Analog frequency command VIN bias	0.1%	-100.0~100.0%
0206H	Bn-07	Analog frequency command AIN gain	0.1%	0.0~1000.0%
0207H	Bn-08	Analog frequency command AIN bias	0.1%	-100.0~100.0%
0208H	Bn-09	Analog multi-function input AUX gain	0.1%	0.0~1000.0%
0209H	Bn-10	Analog multi-function input AUX bias	0.1%	-100.0~100.0%
020AH	Bn-11	Analog multi-function output AO1 gain	0.01	0.01~2.55
020BH	Bn-12	Analog multi-function output AO2 gain	0.01	0.01~2.55
020CH	Bn-13	PID Detection gain	0.01	0.01~10.00
020DH	Bn-14	PID Proportion gain (P)	0.01	0.01~10.00
020EH	Bn-15	PID Integral Time (I)	0.01s	0.00~100.00s

020FH	Bn-16	PID Differential time (D)	0.01s	0.00~1.00s
0210H	Bn-17	PID Deviation	1%	0~109%
0211H	Bn-18	Power saving gain	1%	50~150%
0212H	Bn-19	Auto torque compensation gain	0.1	0.0~2.0
0213H	Bn-20	Timer ON delay time	0.1s	0.0~6000.0s
0214H	Bn-21	Timer OFF delay time	0.1s	0.0~6000.0s
0215H	Bn-22	1’st Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0216H	Bn-23	2’nd Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0217H	Bn-24	3’rd Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0218H	Bn-25	4’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0219H	Bn-26	5’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021AH	Bn-27	6’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021BH	Bn-28	7’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021CH	Bn-29	8’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021DH	Bn-30	9’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021EH	Bn-31	10’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
021FH	Bn-32	11’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0220H	Bn-33	12’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0221H	Bn-34	13’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0222H	Bn-35	14’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0223H	Bn-36	15’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0224H	Bn-37	16’th Step Time Under Auto Run Mode	0.1s	0.0~6000.0s
0225H	Bn-38	Display content after Power ON	-	00~15

Address	Inverter Parameter		Unit	Setting Range
0300H	Cn-01	Input Voltage	0.1V	150.0~255.0V[*1]
0301H	Cn-02	Max. Output Frequency	0.1Hz	50.0~400.0Hz
0302H	Cn-03	Max. Voltage	0.1V	0.1~255.0V[*1]
0303H	Cn-04	Frequency of the Max. Voltage	0.1Hz	0.1~400.0Hz
0304H	Cn-05	Middle Output Frequency	0.1Hz	0.1~400.0Hz
0305H	Cn-06	Voltage at Middle Output Frequency	0.1V	0.1~255.0V[*1]
0306H	Cn-07	Min. Output Frequency	0.1Hz	0.1~400.0Hz
0307H	Cn-08	Voltage at Min. Output Frequency	0.1V	0.1~255.0V[*1]
0308H	Cn-09	Motor Rated Current	0.1A	*2
0309H	Cn-10	No Load Current of Motor	1%	0~99%
030AH	Cn-11	Rated Slip of Motor	0.1%	0~9.9%
030BH	Cn-12	Line to Line Resistor of Motor	0.00 1Ω	0~65.535Ω
030CH	Cn-13	Motor ferrous loss	1W	0~65535W

030DH	Cn-14	DC Injection Braking Starting Frequency	01.Hz	0.1~10.0Hz
030EH	Cn-15	DC Brake Current	1%	0~100%
030FH	Cn-16	DC Injection Braking Time at Stop	0.1s	0.0~25.5s
0310H	Cn-17	DC Injection Braking Time at Start	0.1s	0.0~25.5s
0311H	Cn-18	Frequency Command Upper Bound	1%	0~109%
0312H	Cn-19	Frequency Command Lower Bound	1%	0~109%
0313H	Cn-20	Frequency Jump Point 1	0.1Hz	0.0~400.0Hz
0314H	Cn-21	Frequency Jump Point 2	0.1Hz	0.0~400.0Hz
0315H	Cn-22	Frequency Jump Point 3	0.1Hz	0.0~400.0Hz
0316H	Cn-23	Frequency Jump Range	0.1Hz	0.0~25.5Hz
0317H	Cn-24	Number of times, Reset after fault	-	0~10
0318H	Cn-25	Stall Prevention During Acceleration	1%	30~200%
0319H	Cn-26	Stall Prevention During Running	1%	30~200%
031AH	Cn-27	Communication Fault Detection Time	0.1s	0.0~25.5s
031BH	Cn-28	Display mode, Digital Controller	-	0-39999
031CH	Cn-29	Random Frequency Detection Level, accelerating	0.1Hz	0.0~400.0Hz
031DH	Cn-30	Random Frequency Detection Level, decelerating	0.1Hz	0.0~400.0Hz
031EH	Cn-31	Detection amplitude, for consistent Frequency	0.1Hz	0.1~25.5Hz
031FH	Cn-32	Detection Level, Over Torque	1%	30~200%
0320H	Cn-33	Detection Time, Over Torque	0.1s	0.0~25.5s
0321H	Cn-34	Carrier Frequency Setting	-	1~6
0322H	Cn-35	Speed Search Detection Level	1%	0~200%
0323H	Cn-36	Speed Search Time	0.1s	0.1~25.5s
0324H	Cn-37	Min. Base Block Time	0.1s	0.5~5.0s
0325H	Cn-38	V/F Curve in Speed Searching	1%	10~100%
0326H	Cn-39	Detection Level, Under Voltage	1V	150~210V
0327H	Cn-40	S-curve Characteristic Time at Accel. Start	0.1s	0.0~1.0s
0328H	Cn-41	S-curve Characteristic Time at Accel. End	0.1s	0.0~1.0s
0329H	Cn-42	S-curve Characteristic Time at Decel. Start	0.1s	0.0~1.0s
032AH	Cn-43	S-curve Characteristic Time at Decel. End	0.1s	0.0~1.0s
032BH	Cn-44	PID Integral Upper Bound	1%	0~109%
032CH	Cn-45	PID Primary Delay Time Constant	0.1s	0.0~2.5s
032DH	Cn-46	Resistance, Motor winding	0.00 1Ω	0.000~65.535Ω
032EH	Cn-47	Resistance, Motor Rotor	0.00 1Ω	0.000~65.535Ω
032FH	Cn-48	Motor Equivalent Inductance Leak	0.01mH	0.00~655.35mH
0330H	Cn-49	Motor Equivalent Inductance	0.1mH	0.0~6553.5 mH

0331H	Cn-50	Slip Compensation Gain	0.01	0.00~2.55
0332H	Cn-51	Slip Compensation Delay	0.1s	0.0~25.5s

*1: Setting range for 220V. Multiply by 2 for 440V.
*2: Setting range is 10~200% of Inverter rated current.

Address	Inverter Parameter		Unit	Setting Range
0400H	Sn-01	Inverter Capacity	-	01~13
0401H	Sn-02	V/F Curve selection	-	00~15
0402H	Sn-03	Operation and initiation modes	-	00~14
0403H	Sn-04	Run Source selection	-	0~2
0404H	Sn-05	Frequency Command selection	-	0~2
0405H	Sn-06	STOP method selection	-	0~3
0406H	Sn-07	Controller STOP button selection	-	0~1
0407H	Sn-08	Prohibition of REV run	-	0~1
0408H	Sn-09	Output frequency Up/Down function	-	0~1
0409H	Sn-10	UP/DOWN adjustment of output Frequency	-	0~1
040AH	Sn-11	Analog Frequency Input command properties selection	-	0~3
040BH	Sn-12	Analog Frequency Command Input properties selection	-	0~1
040CH	Sn-13	ZERO Command Braking function selection	-	0~1
040DH	Sn-14	Output Voltage Limit selection	-	0~1
040EH	Sn-15	Stall prevention during Accel. function selection	-	0~1
040FH	Sn-16	Stall prevention during Decel. function selection	-	0~1
0410H	Sn-17	Stall prevention during running function selection	-	0~2
0411H	Sn-18	Re-Start selection after momentary interruption	-	0~1
0412H	Sn-19	Motor overload protection select	-	0~4
0413H	Sn-20	Over Torque Detection select	-	0~4
0414H	Sn-21	Contact select for restart from emergency stop	-	0~1
0415H	Sn-22	External fault ③ contact selection	-	0~1
0416H	Sn-23	External fault ③ detection selection	-	0~1
0417H	Sn-24	External fault operation selection	-	0~3
0418H	Sn-25	DI ⑤ function selection	-	00~21
0419H	Sn-26	DI ⑥ function selection	-	01~22
041AH	Sn-27	DI ⑦ function selection	-	02~23

041BH	Sn-28	DI ⑧ function selection	-	03~24
041CH	Sn-29	Aux function selection	-	00~11
041DH	Sn-30	R1A-R1B-R1C function selection	-	00~25
041EH	Sn-31	DO1 function selection	-	00~25
041FH	Sn-32	R2A-R2C function selection	-	00~25
0420H	Sn-33	Multiplier select, Pulse output	-	01~16
0421H	Sn-34	AO1 function selection	-	00~11
0422H	Sn-35	AO2 function selection	-	00~11
0423H	Sn-36	Inverter Address	-	01~31
0424H	Sn-37	RS-485 communication baud rate setting	-	0~3
0425H	Sn-38	RS-485 communication transmission parity setting	-	0~2
0426H	Sn-39	RS-485 communication Fault stop selection	-	0~2
0427H	Sn-40	Selection of load	-	0~1
0428H	Sn-41	PID function selection	-	0~1
0429H	Sn-42	Brake resistor protection function select	-	0~1
042AH	Sn-43	Motor parameter Auto-test function select	-	0~1
042BH	Sn-44	Selection of Control modes	-	0~1
042CH	Sn-45	Auto Run mode operation selection	-	0~6
042DH	Sn-46	Auto Run mode operation selection 1	-	0~2
042EH	Sn-47	Auto Run mode operation selection 2	-	0~2
042FH	Sn-48	Auto Run mode operation selection 3	-	0~2
0430H	Sn-49	Auto Run mode operation selection 4	-	0~2
0431H	Sn-50	Auto Run mode operation selection 5	-	0~2
0432H	Sn-51	Auto Run mode operation selection 6	-	0~2
0433H	Sn-52	Auto Run mode operation selection 7	-	0~2
0434H	Sn-53	Auto Run mode operation selection 8	-	0~2
0435H	Sn-54	Auto Run mode operation selection 9	-	0~2
0436H	Sn-45	Auto Run mode operation selection 10	-	0~2
0437H	Sn-56	Auto Run mode operation selection 11	-	0~2
0438H	Sn-57	Auto Run mode operation selection 12	-	0~2
0439H	Sn-58	Auto Run mode operation selection 13	-	0~2
043AH	Sn-59	Auto Run mode operation selection 14	-	0~2
043BH	Sn-60	Auto Run mode operation selection 15	-	0~2
043CH	Sn-61	Auto Run mode operation selection 16	-	0~2

0500H	Save An, Bn, Sn and Cn parameters into EEPROM	-	*2

*1 0100H~02FFH registered addresses can be written in both DRV and PRG modes.

*2 Write 0000H here will save the parameters into EEPROM

※ Reading of all parameters are not confined with any limitations of modes, but writing is only applicable in the PRG mode unless specified otherwise.

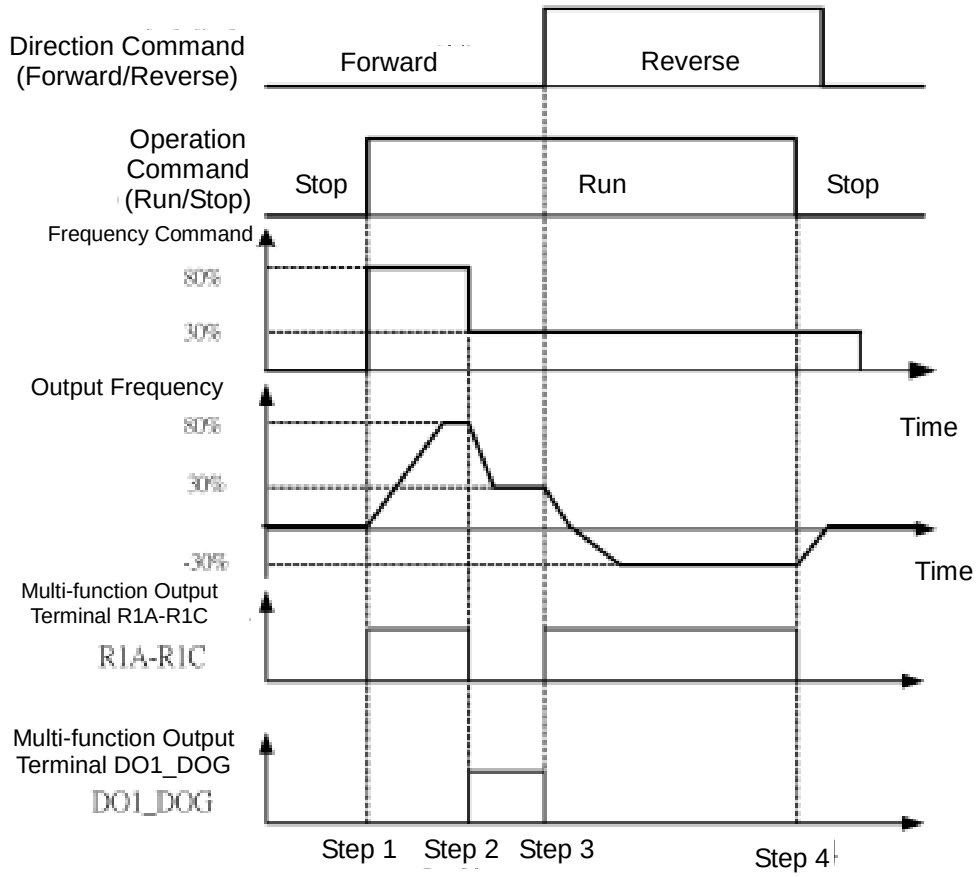
8. Content of Error Codes

Content of error message display is as per the following Table:

Error Code	Error Name	Possible Cause
01H	Function Code Error	Function code is not 03H, 08H or 10H; or Function code is 08H but sub- Function code is not 0000H
02H	Data Address Error	Invalid register address during Retrieval / Writing of command
03H	Data Value Error	Invalid data during Read / Write of command
04H	CRC_16 Error	CRC reception differs from calculated CRC
21H	Device Busy	Handling task of the previous command, such as parameter change or storing data into EEPROM
22H	Device Fail	EEPROM fail while writing data
No response	Data Format Error	Invalid format of received data
No response	UART Error	Parity bit, Overrun or Frame error detected during transfer.

9. Example of TDS-V8 Communication

Demonstrates how a TDS-V8 Inverter, with communication address 1, is controlled by PLC via the RS-485 port for the following operations:



Correctly setup inverter parameters Sn-37 (transfer speed), Sn-38 (Parity setting), Sn-39 (Inverter stop method during RS-485 communication failure) and Cn-27 (Detection time for releasing alarm after a communication failure) according to the previous descriptions, then setup the following parameters:

(i) Sn-36 = 01 (Inverter Address)

(ii) Sn-04 =2 (Operation Command controlled by RS-485 communication)

(iii) Sn-05 =2 (Main Speed Command controlled by RS-485 communication)

(iv) Sn-30 =25 (Terminal R1A controlled by RS-485 communication)

(v) Sn-31 =25 (Terminal DO1 controlled by RS-485 communication)

Then connect cables according to wiring procedures and carry out communication. Configure the Master (PLC) Controller with the following program for accomplishing the desired operations:

Step 1:

Command message sent by Master

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	08H
Data Byte Count		10H
1st Data byte	High Byte	00H
	Low Byte	01H
2nd Data byte	High Byte	5DH
	Low Byte	C0H
3rd Data byte	High Byte	00H
	Low Byte	00H
4th Data byte	High Byte	00H
	Low Byte	00H
5th Data byte	High Byte	00H
	Low Byte	00H
6th Data byte	High Byte	00H
	Low Byte	00H
7th Data byte	High Byte	00H
	Low Byte	00H
8th Data byte	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	44H
	Low Byte	91H

Response message from Slave (Inverter)

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	08H
CRC-16	High Byte	C1H
	Low Byte	CFH

Note:

1. Send 1st Data byte 0001H to register 0000H, stand for Forward Run.
2. Send 2nd Data byte 5DC0H to register 0001H, for running in 80% speed; Cn-02 (Max. Frequency output) is100%(7530H).
3. Send 8th Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals R1A-R1C and disable DO1-DOG.
4. Then the Inverter is initiated; multi-function output terminals R1A-R1C activated, and acceleration is carried out to 80% of max. Output Frequency according to Acceleration Time.

Step 2:

Command message sent by Master

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	08H
Data Byte Count		10H
1st Data byte	High Byte	00H
	Low Byte	01H
2nd Data byte	High Byte	3AH
	Low Byte	98H
3rd Data byte	High Byte	00H
	Low Byte	00H
4th Data byte	High Byte	00H
	Low Byte	00H
5th Data byte	High Byte	00H
	Low Byte	00H
6th Data byte	High Byte	00H
	Low Byte	00H
7th Data byte	High Byte	00H
	Low Byte	00H
8th Data byte	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	FDH
	Low Byte	2EH

Inverter return from Slave (Inverter)

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	08H
CRC-16	High Byte	C1H
	Low Byte	CFH

Note:

1. Send 1st Data byte 0001H to register 0000H, stand for Forward Run.
2. Send 2nd Data byte 3A98H to register 0001H, for running in 50% speed.
3. Send 8th Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals R1A-R1C.
4. Then the Inverter multi-function output terminals DO1-DOG are disabled and R1A-R1C activated, and deceleration is carried out to 50% of max. Output Frequency according to Deceleration Time.

Step 3

Command message sent by Master

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Data Byte Count		10H
1st Data byte	High Byte	00H
	Low Byte	03H
2nd Data byte	High Byte	3AH
	Low Byte	98H
3rd Data byte	High Byte	00H
	Low Byte	00H
4th Data byte	High Byte	00H
	Low Byte	00H
5th Data byte	High Byte	00H
	Low Byte	00H
6th Data byte	High Byte	00H
	Low Byte	00H
7th Data byte	High Byte	00H
	Low Byte	00H
8th Data byte	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	7FH
	Low Byte	2FH

Inverter return from Slave (Inverter)

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	08H
CRC-16	High Byte	C1H
	Low Byte	CFH

Note:

1. Send 1st Data byte 0003H to register 0000H, stand for Reverse Run.
2. Send 2nd Data byte 3A98H to register 0001H, for running in 50% speed.
3. Send 3rd Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals R1A-R1C.
4. Then the Inverter shall decelerate to Stop from 50% speed and reverse and accelerate to 50% of the full Reverse speed; multi-function output terminals R1A-R1C continue Output actions.

Step 4:

Command message sent by Master

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	01H
Data Byte Count		02H
1st Data byte	High Byte	00H
	Low Byte	00H
CRC-16	High Byte	A6H
	Low Byte	50H

Inverter return from Slave (Inverter)

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	00H
Access Count	High Byte	00H
	Low Byte	01H
CRC-16	High Byte	C1H
	Low Byte	C9H

Note:

1. Send 1st Data byte 0000H to register 0000H, stand for stopping the operation.
2. Then the Inverter decelerates from 50% Reverse to ZERO speed and stop operation. Since the content of 0007H register has not been changed, the multi-function output terminals R1A-R1C continue their Output actions.